

ON THE GEOGRAPHICAL RELATIONS OF THE PULMONIFEROUS MOLLUSCA OF VICTORIA.

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As the result of two lengthy holidays spent in Victoria, for the especial purpose of studying its natural history, I hold the opinion that that country is extremely poor in species of land and fresh-water snails. This paucity of species is the more surprising and disappointing, as from the varied surface features of the country, its perennial streams, lakes of fresh water, humid glens, and other favourable habitats of the molluscan denizens of land and water, one would have expected to find a rich fauna.

But despite the very close searching which I have made about Hamilton, Clunes, Ballarat, Fernshaw, and around Port Philip Bay, I have encountered very few species, and, for the most part individuals are not at all numerous.

Correspondence with other observers who have collected in Gippsland and the Cape Otway Ranges has elicited the same experiences.

The list of the fluviatile pulmoniferous snails comprises *Limnæa*, two species; *Aplexa*, five species; and *Ancylus*, one species; making a total of eight, or less than ten per cent. of the described species inhabiting Australia. Only one of the eight—*Ancylus australicus*—is extra-limital, occurring near Adelaide and about Melbourne. (For list of species see Appendix II., p. 76).

The terrestrial pulmonates, which all belong to the family Helicidæ, are represented by a comparatively limited number of species.

Dr. Cox, who has embodied in his "Monograph of the Land Shells of Australia" the labours of previous authors, mentions only four species of *Helix* and one species of *Vitrina*.

Mr. Brazier, Proc. Zool. Soc., 1871, describes, as new, one species of *Helix* and one species of *Bulimus*.

The Rev. J. E. Tenison Woods, Proc. Lin. Soc. N.S.W., 1878, describes a new *Helix*, and adds a previously unrecorded species.

Mr. Petterd, in Journ. of Conchology and in his "Tasmanian

Land Shells," adds 9 species of *Helix* and 1 sp. of *Vitrina*; and in *litteris* a *Succinea* and *Helix* n. sp.

My own collections furnish four species of *Helix* not previously known to occur.

To summarise, Victoria is now known to be inhabited by 23 indigenous species of land snails, distributed as follows:—*Helix*, 18 species; *Helicarion*, 1; *Vitrina*, 2; *Bulimus*, 1; and *Succinea*, 1.

The generic grouping of the land snails of Victoria is identically that of those of Tasmania. The genera represented are all in common, one of which, *Helicarion*, is not found in any other parts of Australia. Victoria as well as Tasmania is marked by the absence of the genus *Pupa*, so well represented in the neighbouring colonies of South Australia and New South Wales, and by the absence of the operculated genus *Pupina*, which links the molluscan fauna of New South Wales with that of sub-tropical Queensland.

Nanina, represented by a widely distributed species, is common to extra-tropical South Australia and tropical Queensland, but is not known in the south-east of Australia.

The geographical distribution of the genera of terrestrial pulmonates inhabiting South and South-Eastern Australia is shown in the following table:—

GENERA.	SOUTH AUSTRALIA.	VICTORIA.	TASMANIA.	NEW SOUTH WALES.
<i>Helix</i>	41	18	66	67
<i>Vitrina</i> .. .. .	..	2	1	7
<i>Helicarion</i> .. .. .	..	1	2	..
<i>Nanina</i>	1	..	..	..
<i>Bulimus</i>	5	1	2	2
<i>Pupa</i>	2	..	..	3
<i>Stenogyra</i> .. .. .	..	..	..	1
<i>Succinea</i>	2	1	2	3
<i>Pupina</i> .. .. .	..	..	..	2
Total species	51	23	73	85

I have excluded from my survey the consideration of the slugs, as the information we are in possession of is very meagre, possibly because so little attention has been given to them. However, Tasmania has the peculiar genus *Cystopelta* (*C. Petterdi*, mihi), a *Limax* (*L. Legrandi*, mihi), and a *Milax* (*M. Tasmanicus*, mihi). South Australia affords one species of *Milax* (*M. nigritus*, mihi); and New South Wales a *Milax* (*M. olivaceus*, Gould), and a peculiar genus of bitentaculate slug *Triboniophorus* (*T. Græffii*), Humbert.

Touching the specific alliances of the Victorian terrestrial mollusca, we are at once arrested by the fact that only about one-half of the total number of species are endemic, and of these two, at least, are so closely related to Tasmanian species that had they been found living in the same geographical region they would have been regarded as not more than varietal forms. Of the extra-limital species, seven occur in Tasmania, and there is a slight community with South Australia and with New South Wales. The geographical range of the Victorian species is set forth in Appendix I.

That there should be some specific points of contact between the molluscan fauna of Victoria and Tasmania is not surprising; but that there should be so large a proportion in common is most startling. Thanks to Mr. Petterd, I have had the means of comparing Tasmanian and Victorian examples of all the species in common, and after a most rigid examination I am forced to acknowledge the specific identity of seven. Mr. Petterd considers also *Helix ruga* and *H. Allporti* to have place in the same category; but as the Victorian examples show differential characters, I have regarded them as distinct species. It is true that the differences are so very trivial that but for the fact of the shells exhibiting them are found so isolated from their congeners, one would not be justified in separating them. If the other extreme view be adopted, then there are nine species, out of a total of 23, in common between Victoria and Tasmania.

Referring again to the table giving the number of species inhabiting Victoria and its neighbouring colonies, we may well ask, why this paucity of species? It certainly cannot be attributed to climatic conditions, as South Australia, with its drier climate, possesses about 50 species, many of which inhabit regions subjected to continued droughts and scorching heats; whilst Tasmania, which is paralleled with the alpine regions of Victoria, counts 73, and has, moreover, a rich and varied group of aquatic pulmonate snails. I would fain seek a cause in recent geological changes. It is popularly held, but I think erroneously, that Australia is an ancient continent. But the present configuration of the surface of Victoria is largely due to forces which have exerted their influence over vast areas, and at comparatively recent times. A glance at a geological map of the colony will satisfy you that the larger portion of it, on the south of the main watershed, is covered with igneous rock; and a personal examination would result in the opinion that much of the remainder had been similarly mantled over, from which it has been stripped in later years. Now, the period, at which this vast sheet of basalt and porphy-

ritic traps* was ejected, was at about the incoming of existing species. Such a deluge of igneous mass must have destroyed terrestrial forms of life over the greater part of the southern region of Victoria. A small portion of south-east South Australia and part of Tasmania were involved in this catastrophe. From this it may be inferred, that the outlying regions unaffected by the volcanic disturbances retained their faunas and floras in all their pristine characters, whilst, on the other hand Victoria was reduced to the condition of a tenantless tract, which was re-peopled by migration from surrounding areas. A remnant of its more ancient flora and fauna was doubtlessly preserved in the Grampians and other similar mountain masses, which would seem to have been, in part at least, beyond the reach of the volcanic eruptions.

Into this organically new region immigration would take place; forms of limited means of dispersal would probably undergo morphological change *in transitu*; others with greater inherent powers of locomotion, or those which were transported, *nolens volens*, with rapidity, may have continued unaltered. Thus it may be conjectured that the endemic forms are either remnants of an older fauna, or are modified from extra-limital immigrants. Of the first, *Helicarion atramentaria* may be cited, and of the latter, *Helix exoptata*. Whilst *Helix brevipila* may be mentioned as an example of an immigrant form which has resisted modification.

Touching the introduction of continental forms no special difficulty exists, but in respect to that of the species common to Tasmania and the continent the case is different. Such community of species implies a land connection, or at least a closer proximity than what actually occurs at the present day. A community of species is traceable as far back in geologic time as the period of the formation of the Pleistocene sandrock which fringes the southern coast line of Australia and the islands in Bass Straits. The Pleistocene sandstone of Badger, Barren, and other islands have yielded to the researches of Mr. R. M. Johnston (Trans. Roy. Soc. Tasmania for 1878, p. 41, *et seq.*) the following living continental forms:—*Helix pictilis*, *Succinea australis*, *Aplexa tenuistriata*, and *Pomatiopsis striatula*; the first of which occurs in similar deposits at Cape Northumberland. I have elsewhere (Trans. Roy. Soc. S. Aust., vol. ii., p. lxxviii.) pointed out that the Pleistocene sandstone was accumulated when the land stood relatively higher than it does now, and may thus have constituted a land connection between Tasmania and the continent, by way of which an interchange of

* I consider the so-called porphyrites of Macedon, Dandenong, and other high peaks to belong to the same geological series as the well-known basalts.

those plants and animals, whose migrations are not aided by external agents of dispersal, may have been effected.

APPENDIX I.

LIST OF VICTORIAN TERRESTRIAL PULMONIFEROUS SNAILS.

SPECIES.	VICTORIAN LOCALITIES.	EXTRA-LIMITAL RANGE
HELIX.		
Melbournensis, <i>Cox</i>	(An asterisk indicates the locality of the type example.) *Melbourne; Fernshaw (<i>Ptrd.</i>)	
Victoriae, <i>Cox</i>	*Western Pt.; C. Otway (<i>Ptrd.</i>)	
brevipila, <i>Pfr.</i>	Victoria (<i>Cox</i>); Melb. (<i>Ptrd.</i>)	N.S.W., S.Aust.
Hobarti, <i>Cox</i>	Dandenong; Melbrne. (<i>Ptrd.</i>)	Tasm., S.Aust.
Mortii, <i>Cox</i>	Burrumbeet (<i>Tate</i>)	N.S.W., Tasm., S.A.
juloidea, <i>Forbes</i>	Melb. (<i>Woods</i>); Geelong; Muddy Creek (<i>Tate</i>)	Qnsld., N.S.W., S.A.
sub-depressa, <i>Brazier</i>	*Snowy R.; Dandenong (<i>Petterd</i> as <i>H. Dandenongensis</i>); Fernshaw (<i>Tate</i>)	
McCoyi, <i>Petterd</i>	*Dandenong (<i>Petterd</i>); Fernshaw (<i>Tate</i>)	Allporti, Tasm., var McCoyi, <i>Petterd</i>
Fernshawensis, <i>Ptd.</i> (1)	*Fernshaw	
mucoides, <i>Woods</i>	*Melbourne	
Stanleyensis, <i>Ptrd.</i> (2)	*Fernshaw	Tasm.
Otwayensis, <i>Petterd</i>	*Cape Otway	Tasm.
mansueta, <i>Pfr.</i> (?)	Fernshaw (<i>Tate</i>)	Qnsld., N.S.W.
Tamarensis, <i>Petterd</i>	Burrumbeet (<i>Tate</i>)	Tasm.
exoptata, <i>Tate</i>	Dandenong, Sale, and C. Otway (<i>Ptrd.</i>) as <i>H. ruga</i> ; Fernshaw (<i>Tate</i>)	
sp. to be named	Burrumbeet (<i>Tate</i>)	
sp. to be named	Burrumbeet (<i>Tate</i>)	
Garthii, <i>Petterd</i> , M.S.	*Fernshaw	
HELICARION,		
atramentaria, <i>Shutt.</i>	Mt. Arnold and Bendigo (<i>Cox</i>); Fernshaw (<i>Tate</i>)	
VITRINA.		
nigra, <i>Quoy & Gaimard</i>	*Western Port	
Verreauxi, <i>Pfeiffer</i>	Fernshaw, Sale, Gippsland, Cape Otway (<i>Petterd</i>)	Tasm.
BULINUS.		
Kershawi, <i>Brazier</i>	*Snowy River	
SUCCINEA.		
australis, <i>Quoy & Grd.</i>	Western Port (<i>Quoy</i>) Melbourne (<i>Petterd</i>)	S. Aust. Tasm.

(1). Possibly an immature, *H. McCoyi*.(2). *Syn.*—*Petterdiana*, Taylor, non Brazier.

APPENDIX II.

LIST OF VICTORIAN FRESHWATER PULMONIFEROUS SNAILS:—

Limnæa Melbournensis, Pfeiffer. Melbourne (types); Lake Wendouree, Ballarat (*Tate*).

Limnæa viridula, *Tate*. Murndal, Hamilton (*Tate*).

Aplexa Yarraensis, *T. Woods*. Upper Yarra (type).

Aplexa arachnoidea, *T. Woods*. Mordialloc (type).

Aplexa crebreciliata, *T. Woods*; *incol. pilosa*, *T. Woods*. Caulfield, Melbourne (types).

Aplexa Kershawi, *T. Woods*. Upper Yarra (type), Clunes Reservoir (*Tate*).

Aplexa turrata, *Tate*. L. Wendouree, Ballarat (*Tate*).

Ancylus australicus, *Tate*. Melbourne (*Tate*).
